The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Albany, New York 12234

Reference Tables for Chemistry

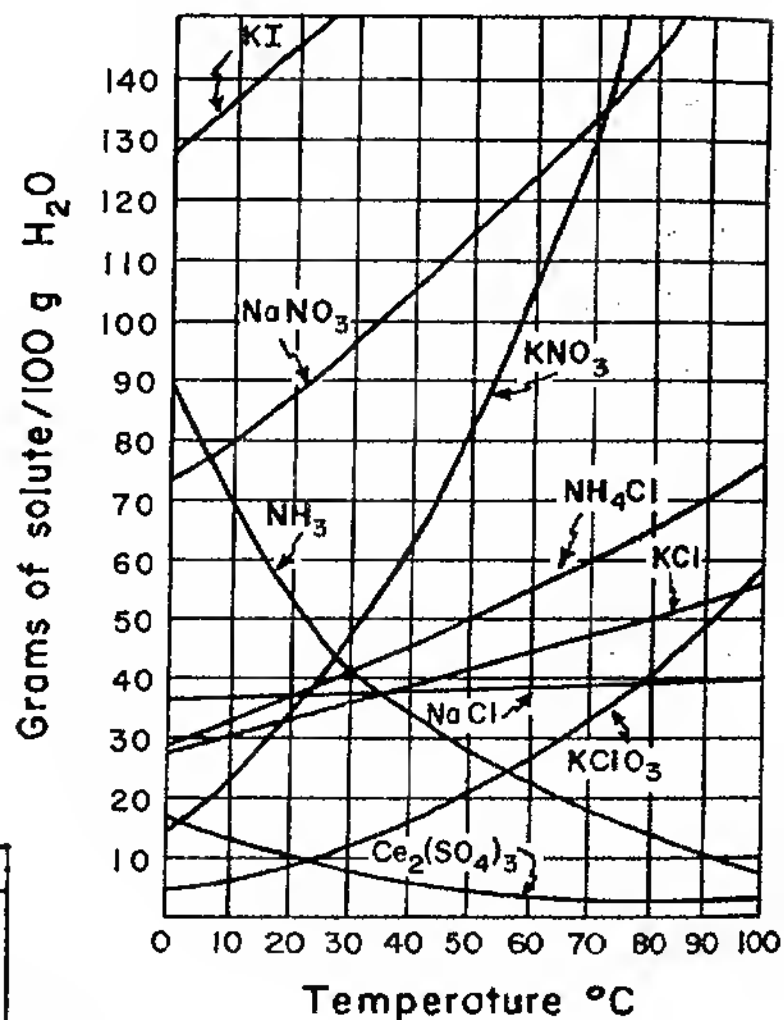
A

DENSITY AND BOILING POINTS OF SOME COMMON GASES			
Name		*Density grams/liter at STP**	*Boiling Point (at 1 atm) K*
Air	—	1.29	—
Ammonia	NH_3	0.771	240
Carbon dioxide	CO_2	1.98	195
Carbon monoxide	CO	1.25	82
Chlorine	Cl_2	3.21	172
Hydrogen	H_2	0.0899	20
Hydrogen chloride	HCl	1.64	188
Hydrogen sulfide	H_2S	1.54	212
Methane	CH_4	0.714	109
Nitrogen	N_2	1.25	77
Nitrogen (II) oxide	NO	1.34	121
Oxygen	O_2	1.43	90
Sulfur dioxide	SO_2	2.93	263

*STP is defined as 273K or 0°C and 1 atm or 760 torr

B

SOLUBILITY CURVES



C

TABLE OF SOLUBILITIES IN WATER

i — nearly insoluble
ss — slightly soluble
s — soluble
d — decomposes
n — not isolated

	acetate	bromide	carbonate	chloride	chromate	hydroxide	iodide	nitrate	phosphate	sulfate	sulfide
Aluminum	ss	s	n	s	n	i	s	s	i	s	d
Ammonium	s	s	s	s	s	s	s	s	s	s	s
Barium	s	s	i	s	i	s	s	s	i	i	d
Calcium	s	s	i	s	s	ss	s	s	i	ss	d
Copper II	s	s	i	s	i	i	d	s	i	s	i
Iron II	s	s	i	s	n	i	s	s	i	s	i
Iron III	s	s	n	s	i	i	n	s	i	ss	d
Lead	s	ss	i	ss	i	i	ss	s	i	i	i
Magnesium	s	s	i	s	s	i	s	s	i	s	d
Mercury I	ss	i	i	i	ss	n	i	s	i	ss	i
Mercury II	s	ss	i	s	ss	i	i	s	i	d	i
Potassium	s	s	s	s	s	s	s	s	s	s	s
Silver	ss	i	i	i	ss	n	i	s	i	ss	i
Sodium	s	s	s	s	s	s	s	s	s	s	s
Zinc	s	s	i	s	s	i	s	s	i	s	i

D

SELECTED POLYATOMIC IONS			
CH_3COO^-	acetate	MnO_4^-	permanganate
CN^-	cyanide	MnO_4^{2-}	manganate
CO_3^{2-}	carbonate	NH_4^+	ammonium
HCO_3^-	hydrogen carbonate	NO_2^-	nitrite
$C_2O_4^{2-}$	oxalate	NO_3^-	nitrate
ClO^-	hypochlorite	OH^-	hydroxide
ClO_2^-	chlorite	PO_4^{3-}	phosphate
ClO_3^-	chlorate	SCN^-	thiocyanate
ClO_4^-	perchlorate	SO_3^{2-}	sulfite
CrO_4^{2-}	chromate	SO_4^{2-}	sulfate
$Cr_2O_7^{2-}$	dichromate	HSO_4^-	hydrogen sulfate
Hg_2^{2+}	mercury (I)	$S_2O_3^{2-}$	thiosulfate

E

Standard Energies of Formation of Compounds at 1 atm and 298 K		
Compound	*Heat (Enthalpy) of Formation kcal/mole (ΔH_f°)*	*Free Energy of Formation kcal/mole (ΔG_f°)*
Aluminum oxide Al_2O_3 (s)	—399.1	—376.8
Ammonia NH_3 (g)	—11.0	—4.0
Barium sulfate $BaSO_4$ (s)	—350.2	—323.4
Calcium hydroxide $Ca(OH)_2$ (s)	—235.8	—214.3
Carbon dioxide CO_2 (g)	—94.1	—94.3
Carbon monoxide CO (g)	—26.4	—32.8
Copper (II) sulfate $CuSO_4$ (s)	—184.0	—158.2
Ethane C_2H_6 (g)	—20.2	—7.9
Ethene C_2H_4 (g)	12.5	16.3
Ethyne (acetylene) C_2H_2 (g)	54.2	50.0
Hydrogen fluoride HF (g)	—64.2	—64.7
Hydrogen iodide HI (g)	6.2	0.3
Iodine chloride ICl (g)	4.2	—1.3
Lead (II) oxide PbO (s)	—52.4	—45.3
Magnesium oxide MgO (s)	—143.8	—136.1
Nitrogen (II) oxide NO (g)	21.6	20.7
Nitrogen (IV) oxide NO_2 (g)	8.1	12.4
Potassium chloride KCl (s)	—104.2	—97.6
Sodium chloride NaCl (s)	—98.2	—91.8
Sulfur dioxide SO_2 (g)	—71.0	—71.8
Water H_2O (g)	—57.8	—54.6
Water H_2O (ℓ)	—68.3	—56.7

Sample equation

$2Al\ (s) + \frac{3}{2}O_2\ (g) \rightarrow Al_2O_3\ (s)$

F

SELECTED RADIOISOTOPES		
Nuclide	*Half-Life*	*Particle Emission*
^{14}C	5730 y	β^-
^{60}Co	5.3 y	β^-
^{137}Cs	30.23 y	β^-
^{220}Fr	27.5 s	α
^{3}H	12.26 y	β^-
^{131}I	8.07 d	β^-
^{40}K	1.28×10^9 y	β^+
^{42}K	12.4 h	β^-
^{32}P	14.3 d	β^-
^{226}Ra	1600 y	α
^{90}Sr	28.1 y	β^-
^{235}U	7.1×10^8 y	α
^{238}U	4.51×10^9 y	α

y = years; d = days; h = hours; s = seconds

G

Heats of Reaction at 1 atm and 298K	
Reaction	ΔH (kcal)
$CH_4\ (g) + 2O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (\ell)$	—212.8
$C_3H_8\ (g) + 5O_2\ (g) \rightarrow 3CO_2\ (g) + 4H_2O\ (\ell)$	—530.6
$CH_3OH\ (\ell) + \frac{3}{2}O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (\ell)$	—173.6
$C_6H_{12}O_6\ (s) + 6O_2\ (g) \rightarrow 6CO_2\ (g) + 6H_2O\ (\ell)$	—669.9
$CO\ (g) + \frac{1}{2}O_2\ (g) \rightarrow CO_2\ (g)$	—67.7
$NaOH\ (s) \xrightarrow{H_2O} Na^+\ (aq) + OH^-\ (aq)$	—10.6
$NH_4Cl\ (s) \xrightarrow{H_2O} NH_4^+\ (aq) + Cl^-\ (aq)$	+3.5
$H^+\ (aq) + OH^-\ (aq) \rightarrow H_2O\ (\ell)$	—13.8

H

SYMBOLS USED IN NUCLEAR CHEMISTRY		
electron	$^{0}_{-1}e$	β^-
positron	$^{0}_{+1}e$	β^+
proton	$^{1}_{1}H$	p
alpha particle	$^{4}_{2}He$	α
neutron	$^{1}_{0}n$	n
gamma radiation		γ

(I)

Ionization Energies and Electronegativities

313 ← First Ionization Energy (kcal/mole of atoms)

Electronegativity*

IA	IIA	IIIA	IVA	VA	VIA	VIIA	0
313 H 2.1							567 He
124 Li 1.0	215 Be 1.5	191 B 2.0	260 C 2.5	336 N 3.0	314 O 3.5	402 F 4.0	497 Ne
119 Na 0.9	176 Mg 1.2	138 Al 1.5	188 Si 1.8	254 P 2.1	239 S 2.5	300 Cl 3.0	363 Ar
100 K 0.8	141 Ca 1.0	138 Ga 1.6	187 Ge 1.8	231 As 2.0	225 Se 2.4	273 Br 2.8	323 Kr
96 Rb 0.8	131 Sr 1.0	133 In 1.7	169 Sn 1.8	199 Sb 1.9	208 Te 2.1	241 I 2.5	280 Xe
90 Cs 0.7	120 Ba 0.9	141 Tl 1.8	171 Pb 1.8	185 Bi 1.9	Po 2.0	At 2.2	248 Rn
Fr 0.7	Ra						

(J)

RELATIVE STRENGTHS OF ACIDS IN AQUEOUS SOLUTION at 1 atm AND 298 K

Conjugate Pairs ACID → BASE	K_a
$HI \rightarrow H^+ + I^-$	very large
$HBr \rightarrow H^+ + Br^-$	very large
$HCl \rightarrow H^+ + Cl^-$	very large
$HNO_3 \rightarrow H^+ + NO_3^-$	very large
$H_2SO_4 \rightarrow H^+ + HSO_4^-$	large
$H_2O + SO_2 \rightarrow H^+ + HSO_3^-$	1.7×10^{-2}
$HSO_4^- \rightarrow H^+ + SO_4^{2-}$	1.3×10^{-2}
$H_3PO_4 \rightarrow H^+ + H_2PO_4^-$	7.1×10^{-3}
$Fe(H_2O)_6^{3+} \rightarrow H^+ + Fe(H_2O)_5(OH)^{2+}$	6.0×10^{-3}
$HF \rightarrow H^+ + F^-$	6.7×10^{-4}
$HNO_2 \rightarrow H^+ + NO_2^-$	5.1×10^{-4}
$Cr(H_2O)_6^{3+} \rightarrow H^+ + Cr(H_2O)_5(OH)^{2+}$	1.0×10^{-4}
$CH_3COOH \rightarrow H^+ + CH_3COO^-$	1.8×10^{-5}
$Al(H_2O)_6^{3+} \rightarrow H^+ + Al(H_2O)_5(OH)^{2+}$	1.0×10^{-5}
$H_2O + CO_2 \rightarrow H^+ + HCO_3^-$	4.4×10^{-7}
$H_2S \rightarrow H^+ + HS^-$	1.0×10^{-7}
$H_2PO_4^- \rightarrow H^+ + HPO_4^{2-}$	6.3×10^{-8}
$HSO_3^- \rightarrow H^+ + SO_3^{2-}$	6.2×10^{-8}
$NH_4^+ \rightarrow H^+ + NH_3$	5.7×10^{-10}
$HCO_3^- \rightarrow H^+ + CO_3^{2-}$	4.7×10^{-11}
$HPO_4^{2-} \rightarrow H^+ + PO_4^{3-}$	4.4×10^{-13}
$HS^- \rightarrow H^+ + S^{2-}$	1.3×10^{-13}
$H_2O \rightarrow H^+ + OH^-$	1.0×10^{-14}
$OH^- \rightarrow H^+ + O^{2-}$	$< 10^{-36}$
$NH_3 \rightarrow H^+ + NH_2^-$	very small

(K)

Constants for Various Equilibria at 1 atm and 298 K

$H_2O = H^+(aq) + OH^-(aq)$	$K_w = 1.0 \times 10^{-14}$
$CH_3COO^-(aq) + H_2O = CH_3COOH(aq) + OH^-(aq)$	$K_b = 5.6 \times 10^{-10}$
$NH_3(aq) + H_2O = NH_4^+(aq) + OH^-(aq)$	$K_b = 1.8 \times 10^{-5}$
$CO_3^{2-}(aq) + H_2O = HCO_3^-(aq) + OH^-(aq)$	$K_b = 2.1 \times 10^{-4}$
$Ag(NH_3)_2^+(aq) = Ag^+(aq) + 2NH_3(aq)$	$K_{eq} = 6.3 \times 10^{-8}$
$N_2(g) + 3H_2(g) = 2NH_3(g)$	$K_{eq} = 6.7 \times 10^{5}$
$H_2(g) + I_2(g) = 2HI(g)$	$K_{eq} = 3.5 \times 10^{-1}$

Compound	K_{sp}	*Compound*	K_{sp}
AgCl	1.6×10^{-10}	$PbCl_2$	1.6×10^{-5}
AgBr	7.7×10^{-13}	$PbCrO_4$	1.8×10^{-14}
AgI	1.5×10^{-10}	PbI_2	1.4×10^{-8}
$BaSO_4$	1.1×10^{-10}	ZnS	1.6×10^{-23}

L

STANDARD ELECTRODE POTENTIALS	
Ionic Concentrations 1 M Water at 298 K, 1 atm	
Half-Reaction	$E°$ *(volts)*
$F_2(g) + 2e^- \longrightarrow 2F^-$	+2.87
$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$	+1.52
$Au^{3+} + 3e^- \longrightarrow Au(s)$	+1.50
$Cl_2(g) + 2e^- \longrightarrow 2Cl^-$	+1.36
$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$	+1.33
$MnO_2(s) + 4H^+ + 2e^- \longrightarrow Mn^{2+} + 2H_2O$	+1.28
$\frac{1}{2}O_2(g) + 2H^+ + 2e^- \longrightarrow H_2O$	+1.23
$Br_2(\ell) + 2e^- \longrightarrow 2Br^-$	+1.06
$NO_3^- + 4H^+ + 3e^- \longrightarrow NO(g) + 2H_2O$	+0.96
$\frac{1}{2}O_2(g) + 2H^+(10^{-7}M) + 2e^- \longrightarrow H_2O$	+0.82
$Ag^+ + e^- \longrightarrow Ag(s)$	+0.80
$\frac{1}{2}Hg_2^{2+} + e^- \longrightarrow Hg(\ell)$	+0.79
$Hg^{2+} + 2e^- \longrightarrow Hg(\ell)$	+0.78
$NO_3^- + 2H^+ + e^- \longrightarrow NO_2(g) + H_2O$	+0.78
$Fe^{3+} + e^- \longrightarrow Fe^{2+}$	+0.77
$I_2(s) + 2e^- \longrightarrow 2I^-$	+0.53
$Cu^+ + e^- \longrightarrow Cu(s)$	+0.52
$Cu^{2+} + 2e^- \longrightarrow Cu(s)$	+0.34
$SO_4^{2-} + 4H^+ + 2e^- \longrightarrow SO_2(g) + 2H_2O$	+0.17
$Sn^{4+} + 2e^- \longrightarrow Sn^{2+}$	+0.15
$2H^+ + 2e^- \longrightarrow H_2(g)$	0.00
$Pb^{2+} + 2e^- \longrightarrow Pb(s)$	−0.13
$Sn^{2+} + 2e^- \longrightarrow Sn(s)$	−0.14
$Ni^{2+} + 2e^- \longrightarrow Ni(s)$	−0.25
$Co^{2+} + 2e^- \longrightarrow Co(s)$	−0.28
$2H^+(10^{-7}M) + 2e^- \longrightarrow H_2(g)$	−0.41
$Fe^{2+} + 2e^- \longrightarrow Fe(s)$	−0.44
$Cr^{3+} + 3e^- \longrightarrow Cr(s)$	−0.74
$Zn^{2+} + 2e^- \longrightarrow Zn(s)$	−0.76
$2H_2O + 2e^- \longrightarrow 2OH^- + H_2(g)$	−0.83
$Mn^{2+} + 2e^- \longrightarrow Mn(s)$	−1.18
$Al^{3+} + 3e^- \longrightarrow Al(s)$	−1.66
$Mg^{2+} + 2e^- \longrightarrow Mg(s)$	−2.37
$Na^+ + e^- \longrightarrow Na(s)$	−2.71
$Ca^{2+} + 2e^- \longrightarrow Ca(s)$	−2.87
$Sr^{2+} + 2e^- \longrightarrow Sr(s)$	−2.89
$Ba^{2+} + 2e^- \longrightarrow Ba(s)$	−2.90
$Cs^+ + e^- \longrightarrow Cs(s)$	−2.92
$K^+ + e^- \longrightarrow K(s)$	−2.92
$Rb^+ + e^- \longrightarrow Rb(s)$	−2.93
$Li^+ + e^- \longrightarrow Li(s)$	−3.00

M

PHYSICAL CONSTANTS		
Name	*Symbol*	*Values*
Speed of light	c	3.00×10^8 meters/sec
Avogadro number	N_A	6.02×10^{23} per mole
Universal Gas Constant	R	0.0821 liter·atm/mole·K 1.99 cal/mole·K 8.31 joule/mole·K
Planck's Constant	h	6.63×10^{-34} joule·sec 1.58×10^{-37} kcal·sec
Charge of electron	e	1.60×10^{-19} coulomb
Molal freezing point depression constant for H_2O = 1.86C°		
Molal boiling point elevation constant for H_2O = 0.52C°		
Atomic Mass Unit	1 amu = 1.66×10^{-24} g	
Heat Equivalent	1 kcal = 4.19×10^3 joule	
Volume Standard	1 liter = 1.00×10^3 cm³	
Angstrom Unit	1 A = 1.00×10^{-10} meter	
Electron Volt	1 ev = 1.60×10^{-19} joule	

N

VAPOR PRESSURE OF WATER			
°C	torr (mm Hg)	°C	torr (mm Hg)
0	4.6	26	25.2
5	6.5	27	26.7
10	9.2	28	28.3
15	12.8	29	30.0
16	13.6	30	31.8
17	14.5	40	55.3
18	15.5	50	92.5
19	16.5	60	149.4
20	17.5	70	233.7
21	18.7	80	355.1
22	19.8	90	525.8
23	21.1	100	760.0
24	22.4	105	906.1
25	23.8	110	1074.6

Periodic Table of the Ele

Relative atomic mass
$^{12}C = 12.00000$

KEY

Atomic Mass (Weight)	12.01115
Symbol	C
Atomic Number	6
Electron Configuration	$1s^2 2s^2 2p^2$
Selected O	−4, +2, +4
Covalent	0.77

Transition Elements

GROUPS

Period	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII	VIII
1	1.00797 **H** 1; +1 −1; 0.32; $1s^1$								
2	6.939 **Li** 3; +1; 1.23; $1s^2 2s^1$	9.0122 **Be** 4; +2; 0.89; $1s^2 2s^2$							
3	22.9898 **Na** 11; +1; 1.54; $[Ne]3s^1$	24.312 **Mg** 12; +2; 1.36; $[Ne]3s^2$							
4	39.102 **K** 19; +1; 2.03; $[Ar]4s^1$	40.08 **Ca** 20; +2; 1.74; $[Ar]4s^2$	44.956 **Sc** 21; +3; 1.44; $[Ar]3d^1 4s^2$	47.90 **Ti** 22; +2 +3 +4; 1.32; $[Ar]3d^2 4s^2$	50.942 **V** 23; +2 +3 +4 +5; 1.22; $[Ar]3d^3 4s^2$	51.996 **Cr** 24; +2 +3 +6; 1.18; $[Ar]3d^5 4s^1$	54.9380 **Mn** 25; +2 +3 +4 +7; 1.17; $[Ar]3d^5 4s^2$	55.847 **Fe** 26; +2 +3; 1.17; $[Ar]3d^6 4s^2$	58.9332 **Co** 27; 1.16; $[Ar]3d^7 4s^2$
5	85.47 **Rb** 37; +1; 2.16; $[Kr]5s^1$	87.62 **Sr** 38; +2; 1.91; $[Kr]5s^2$	88.905 **Y** 39; +3; 1.62; $[Kr]4d^1 5s^2$	91.22 **Zr** 40; +4; 1.45; $[Kr]4d^2 5s^2$	92.906 **Nb** 41; +3 +5; 1.34; $[Kr]4d^4 5s^1$	95.94 **Mo** 42; +3 +6; 1.30; $[Kr]4d^5 5s^1$	98.9062 **Tc** 43; +4 +6 +7; 1.27; $[Kr]4d^6 5s^1$	101.07 **Ru** 44; +3; 1.25; $[Kr]4d^7 5s^1$	102.905 **Rh** 45; 1.25; $[Kr]4d^8 5s^1$
6	132.905 **Cs** 55; +1; 2.35; $[Xe]6s^1$	137.34 **Ba** 56; +2; 1.98; $[Xe]6s^2$	138.91 **La** 57; +3; 1.69; $[Xe]5d^1 6s^2$	178.49 **Hf** 72; +4; 1.44; $[Xe]4f^{14} 5d^2 6s^2$	180.948 **Ta** 73; +5; 1.34; $[Xe]4f^{14} 5d^3 6s^2$	183.85 **W** 74; +6; 1.30; $[Xe]4f^{14} 5d^4 6s^2$	186.2 **Re** 75; +4 +6 +7; 1.28; $[Xe]4f^{14} 5d^5 6s^2$	190.2 **Os** 76; +3 +4; 1.26; $[Xe]4f^{14} 5d^6 6s^2$	192.2 **Ir** 77; 1.27; $[Xe]4f^{14} 5d^7 6s^2$
7	(223) **Fr** 87; +1; $[Rn]7s^1$	(226) **Ra** 88; +2; 2.20; $[Rn]7s^2$	(227) **Ac** 89; +3; 2.0; $[Rn]6d^1 7s^2$	104	105				

Numbers in parentheses are mass numbers of most stable or most common isotope.

Series							
Lanthanide Series	140.12 **Ce** 58; +3 +4; 1.65	140.907 **Pr** 59; +3; 1.64	144.24 **Nd** 60; +3; 1.64	(145) **Pm** 61; +3; 1.63	150.35 **Sm** 62; +2 +3; 1.62	151.96 **Eu** 63; +2 +3; 1.85	157.25 **Gd** 64
Actinide Series	232.038 **Th** 90; +4; 1.65	231.036 **Pa** 91; +4 +5	238.03 **U** 92; +3 +4 +5 +6; 1.42	237.048 **Np** 93; +3 +4 +5 +6	(244) **Pu** 94; +3 +4 +5 +6	(243) **Am** 95; +3 +4 +5 +6	(247) **Cm** 96

Elements

…tive atomic masses are based on
… = 12.0000

— Selected Oxidation States

— Covalent Atomic Radius (Å)

GROUPS

VIII | IB | IIB | IIIA | IVA | VA | VIA | VIIA | O

Atomic No.	Symbol	Atomic Mass	Oxidation States	Covalent Radius (Å)	Electron Configuration
2	He	4.0026	0	0.31	$1s^2$
5	B	10.811	+3	0.82	$1s^22s^22p^1$
6	C	12.01115	−4, +2, +4	0.77	$1s^22s^22p^2$
7	N	14.0067	−3, −2, −1, +1, +2, +3, +4, +5	0.75	$1s^22s^22p^3$
8	O	15.9994	−2	0.73	$1s^22s^22p^4$
9	F	18.9984	−1	0.72	$1s^22s^22p^5$
10	Ne	20.183	0	0.71	$1s^22s^22p^6$
13	Al	26.9815	+3	1.18	[Ne] $3s^23p^1$
14	Si	28.086	−4, +2, +4	1.11	[Ne] $3s^23p^2$
15	P	30.9738	−3, +3, +5	1.06	[Ne] $3s^23p^3$
16	S	32.064	−2, +4, +6	1.02	[Ne] $3s^23p^4$
17	Cl	35.453	−1, +1, +3, +5, +7	0.99	[Ne] $3s^23p^5$
18	Ar	39.948	0	0.98	[Ne] $3s^23p^6$
27	Co	58.9332	[illegible]	1.16	[Ar] $3d^74s^2$
28	Ni	58.71	+2, +3	1.15	[Ar] $3d^84s^2$
29	Cu	63.54	+1, +2	1.17	[Ar] $3d^{10}4s^1$
30	Zn	65.37	+2	1.25	[Ar] $3d^{10}4s^2$
31	Ga	69.72	+3	1.26	[Ar] $3d^{10}4s^24p^1$
32	Ge	72.59	+2, +4	1.22	[Ar] $3d^{10}4s^24p^2$
33	As	74.9216	−3, +3, +5	1.20	[Ar] $3d^{10}4s^24p^3$
34	Se	78.96	−2, +4, +6	1.17	[Ar] $3d^{10}4s^24p^4$
35	Br	79.909	−1, +1, +5	1.14	[Ar] $3d^{10}4s^24p^5$
36	Kr	83.80	0	1.12	[Ar] $3d^{10}4s^24p^6$
45	Rh	102.905	[illegible]	1.25	[Kr] $4d^85s^1$
46	Pd	106.4	+2, +4	1.28	[Kr] $4d^{10}5s^0$
47	Ag	107.870	+1	1.34	[Kr] $4d^{10}5s^1$
48	Cd	112.40	+2	1.48	[Kr] $4d^{10}5s^2$
49	In	114.82	+3	1.44	[Kr] $4d^{10}5s^25p^1$
50	Sn	118.69	+2, +4	1.40	[Kr] $4d^{10}5s^25p^2$
51	Sb	121.75	−3, +3, +5	1.40	[Kr] $4d^{10}5s^25p^3$
52	Te	127.60	−2, +4, +6	1.36	[Kr] $4d^{10}5s^25p^4$
53	I	126.9044	−1, +1, +5, +7	1.33	[Kr] $4d^{10}5s^25p^5$
54	Xe	131.30	0	1.31	[Kr] $4d^{10}5s^25p^6$
77	Ir	192.2	[illegible]	1.27	[Xe] $4f^{14}5d^76s^2$
78	Pt	195.09	+2, +4	1.30	[Xe] $4f^{14}5d^96s^1$
79	Au	196.967	+1, +3	1.34	[Xe] $4f^{14}5d^{10}6s^1$
80	Hg	200.59	+1, +2	1.49	[Xe] $4f^{14}5d^{10}6s^2$
81	Tl	204.37	+1, +3	1.48	[Xe] $4f^{14}5d^{10}6s^26p^1$
82	Pb	207.19	+2, +4	1.47	[Xe] $4f^{14}5d^{10}6s^26p^2$
83	Bi	208.980	+3, +5	1.46	[Xe] $4f^{14}5d^{10}6s^26p^3$
84	Po	(209)	+2, +4	1.46	[Xe] $4f^{14}5d^{10}6s^26p^4$
85	At	(210)		1.45	[Xe] $4f^{14}5d^{10}6s^26p^5$
86	Rn	(222)	0		[Xe] $4f^{14}5d^{10}6s^26p^6$

Atomic No.	Symbol	Atomic Mass	Oxidation States	Covalent Radius (Å)
64	Gd	[illegible]	+3	1.62
65	Tb	158.924	+3	1.61
66	Dy	162.50	+3	1.60
67	Ho	164.930	+3	1.58
68	Er	167.26	+3	1.58
69	Tm	168.934	+3	1.56
70	Yb	173.04	+2, +3	1.70
71	Lu	174.97	+3	1.56
96	Cm	[illegible]	+3	
97	Bk	(247)	+3, +4	
98	Cf	(251)	+3	
99	Es	(254)		
100	Fm	(257)		
101	Md	(256)		
102	No	(254)		
103	Lr	(257)		